

53. (amended) A plasma etching system in accordance with Claim 1, wherein the electromagnetic wave to generate the plasma has a frequency ranging from 200 MHz to 950 MHz.

54. (amended) A plasma etching method for use in the plasma etching system in accordance with Claim 1, comprising the steps of:

using a mixture of  $\text{Cl}_2 + \text{BCl}_3$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CH}_4$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CH}_4 + \text{Ar}$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CHF}_3$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CH}_2\text{F}_2$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{HCl}$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{HCl} + \text{CH}_4 + \text{Ar}$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{N}_2$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{N}_2 + \text{HCl}$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CHCl}_3$ ; and

etching material of silica, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram under a condition that the mixture has a pressure ranging from 0.1 Pa to 4 Pa.

#### REMARKS

Applicants note that claims 30, 37-49 and 54 stand withdrawn from consideration, but applicants note that since such claims are in dependent form, such claims should be considered allowable upon allowance of the parent claims.

By the present amendment, the specification has been amended to clarify features of the present invention including utilizing the features of the claims in the specification so as to provide clear basis therefor. Additionally, the claims have been amended to recite a plasma etching system or plasma

etching method in that the present invention is directed to a system and method for etching the sample.

Also, submitted herewith is a proposed drawing correction to Fig. 1 to identify by reference numerals various parts which parts have now been described in the specification together with the operation thereof. Upon approval of such drawing corrections, formal drawings incorporating the same will be submitted in accordance with the procedures provided therefor.

As to the objection to claims 7, 17, 23, 33 and 35 as being in improper form, applicants submit that by the present amendment, such objection should now be overcome.

As to the rejection of claims 1-6, 8-16, 18-22, 24-29, 31-32 and 50-53 under 35 U.S.C. §112, first paragraph, this rejection is traversed insofar as it is applicable to the specification and claims, as amended.

In setting forth the rejection, the Examiner contends that the claimed control means for introducing the electromagnetic field, for setting distance between the plate and the sample and for controlling the quantity of reaction between a surface of the planar plate and radicals in the plasma is not described in the specification. Applicants note that the specification has been amended to refer to magnet 3A and 3B, as shown in Fig. 1, which generate magnetic lines of force with a direction substantially vertical or substantially vertical to the planar plate 5 and the sample 6, with the

planar plate 5 having a shape of a disk and having a central section thereof connected to a conductor 34 having a shape of a circular cone of the coaxial cable 4, as described at page 9 of the specification. As described at page 10, the distance between the silicon layer 10 on plate 5 and sample 6 is adjustable in a range from 30 mm to one-half of the sample diameter, i.e. 100 mm, with the distance being adjusted by moving a sample stand 11 upward or downward. As described at page 9, gas introduced into chamber 2 is transformed into plasma by interaction between electromagnetic waves introduced from a coaxial cable 4 onto the planar plate 5 and a magnetic field of magnet 3A and 3B to thereby machine a sample 6 and that a frequency signal from the plasma generating power source 7 and a power source 9 via filter 8 is applied to the plate 5. As described at page 13, a ring-shaped member 12 is arranged in the periphery of sample 6 which member 12 has a surface made of silicon 12 which is brought into contact with the plasma and the configuration includes a capacitor 14 to divide the bias supplied to sample 6 to apply resultant bias to silicon film 13 with a temperature controller 15 being provided to keep temperature of member 12 at a fixed value. The amount of radicals of the plasma incident to the surface of sample 6 is influenced by reaction with the resist mask and member 12 consumes fluorine radicals remaining in the proximity of sample 6 to uniform the amount of radicals incident to the sample 6 with the reaction on the surface of member 12 being

adjustable by the bias regulated by a bias controller and the variation time of the reaction is minimized by cooling function 15. Additionally, a temperature control unit 16 as described at page 13 is arranged on plate 5 to minimize variation with respect to time of the surface reaction of silicon film 10. Applicants therefore submit that the aforementioned features questioned by the Examiner as not being described in the specification are, in fact, described in the specification, such that the rejection under 35 U.S.C. §112, first paragraph, with regard thereto should be overcome.

Insofar as the recited features of claim 21 concerning the transverse magnetic mode not being described in the specification, claim 21 has been amended to delete such features such that claim 21, as amended, should be considered to be in compliance with 35 U.S.C. §112, first paragraph.

By the present amendment of the claims, independent claims 1 and 34 have been amended to recite the feature of a plasma etching system, while reciting the feature of a ring-shaped member being disposed in a periphery of the sample, noting that such feature in claim 1 represents part of the means for making radicals incident to a surface of the sample uniform in quantity and type thereof. It is noted that the feature of a ring-shaped member in claim 1 is incorporated from claim 13, which has been canceled, and in claim 34 incorporated from claim 35, which has been canceled. As described in the specification, as noted above, in accordance

with the present invention, as described at page 16, lines 18-25, for example, the distance between the plate and the sample is suitably arranged according to the diameter of the sample by movement of the sample stand 11 upward or downward and there exists a difference between the central area and peripheral area of the sample as to the distribution of fluoric radicals. Particularly, the density of the radicals in the peripheral area becomes larger than that in the central area, but, in the present invention, since the ring-shaped member is arranged in the peripheral area, the quantity of radicals in the peripheral area is controlled by subjecting the radicals to reaction with the ring-shaped member, so that the difference between the central area and the peripheral area of the fluoric radicals distribution can be suppressed. Accordingly, the entire area of the sample can be etched uniformly in the manner as described in the specification of this application, and applicants submit that such features are now clearly set forth in independent claims 1 and 34 and the dependent claims thereof, and that such features are not disclosed or taught in the cited art, as will become clear from the following discussion.

The rejection of claims 1-6, 8, 10-12, 21-22, 24-29, 32, 34 and 50-53 under 35 U.S.C. §103(a) as being unpatentable over Yokogawa et al, U.S. Patent 5,891,252; the rejection of claim 9 under 35 U.S.C. §103(a) as being unpatentable over Yokogawa et al and further in view of Gupta et al, U.S. Patent

5,902,494; and the rejection of claims 13-16, 18-20, 31 and 36 under 35 U.S.C. §103(a) as being unpatentable over Yokogawa et al and further in view of Mizuno et al, U.S. Patent 5,893,962; such rejections are traversed insofar as they are applicable to the present claims, and reconsideration and withdrawal of the rejections are respectfully requested.

At the outset, in order to support a rejection under 35 U.S.C. §103, reference is made to the decision of In re Fine, 5 USPQ 2d 1596 (Fed. Cir. 1988), wherein the court pointed out that the PTO has the burden under §103 to establish a prima facie case of obviousness and can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. As noted by the court, whether a particular combination might be "obvious to try" is not a legitimate test of patentability and obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. As further noted by the court, one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.

As pointed out above, independent claims 1 and 34 have been amended to recite the feature of a ring-shaped member disposed in a periphery of the sample. Applicants note that

the Examiner has recognized that Yokogawa et al does not show a ring-shaped member as claimed. More particularly, the Examiner in rejecting claim 13 and other claims as being unpatentable over Yokogawa et al in view of Mizuno et al states "Yokogawa et al is applied as above but lacks anticipation of showing the claimed ring-shaped member. Mizuno et al discloses a plasma apparatus similar to the apparatus of Yokogawa et al reference, and in which a ring-shaped member 21 is disposed in a periphery of the sample, including a surface to be brought into the plasma is applied with high-frequency power 30 (see Figs. 1, 3A-3C, 5 and 7, and their descriptions). The Examiner takes Official Notice that it is well known in the art that ring-shaped member disposed around the periphery of the sample makes the radicals, ions or plasma species incident to a surface of the sample..."

(emphasis added)

Turning to Yokogawa et al, this patent relates to a plasma etching apparatus, wherein a distance between a sample 110 and a circular conductive plate 107 can be varied between 2 and 30 cm, as described in col. 7, lines 53-59 of this patent. However, as recognized by the Examiner, Yokogawa et al does not disclose that the ring-shaped member is provided in the periphery of the sample. In order to attempt to meet this limitation, the Examiner refers to Mizuno et al. Applicants note, however, that Mizuno et al relates to an electrode unit for in-situ in a thermal CVD apparatus which is

not a plasma etching apparatus. Moreover, as described with respect to Fig. 7, which is a conventional example of a thermal CVD apparatus for depositing B-W films on a substrate, a shield member 121 is arranged around the substrate holder 113 and the shield member 121 has a ring-plate portion 121a. As pointed out in col. 2, lines 8-24 of Mizuno et al, a combination of the bottom wall of the reactor 111, the ring-plate portion 121a, the cylindrical portion 121b and the substrate holder 113 forms a path through which a purge gas (an inert gas flows). The purge gas can prevent unwanted films from being deposited around the circumference of the substrate holder 113 or on the quartz window 116 and the shield member 121 serves to prevent the heated substrate holder 113 from being directly exposed to the reactive gas. Again, the purpose of the shield member 121 is provided for introducing the purge gas into the reactor and is utilized in a chemical vapor deposition apparatus and not for an etching apparatus as claimed. There is no disclosure or teaching in Yokogawa et al or Mizuno et al of a ring-shaped member disposed in a periphery of the sample as part of means for making radicals incident to a surface of the sample uniform in quantity and type thereof, as recited in claim 1 and the dependent claims of this application, and the Examiner's suggestion of Official Notice has no basis in the cited art, such that Official Notice is challenged and the Examiner is requested to cite art to support the Examiner's position.



Moreover, applicants submit that it cannot be considered obvious to combine the teachings of a CVD apparatus with an etching apparatus for the purposes as claimed, and the Examiner's citation of Mizuno et al represents a hindsight reconstruction attempt of the present invention. See In re Fine, supra. Thus, applicants submit that claim 1 and the dependent claims thereof patentably distinguish over Yokogawa et al and the Mizuno et al in the sense of 35 U.S.C. §103, and such claims should be considered allowable. Applicants note that claim 34 recites similar features with respect to the ring-shaped member and hereagain, Yokogawa et al and Mizuno et al fail to disclose or teach the claimed features in the sense of 35 U.S.C. §103, such that claim 34 and its dependent claims should be considered allowable thereover.

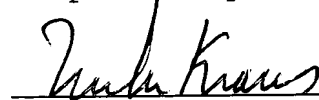
With respect to the features recited in the dependent claims, applicants submit that the Examiner has failed to show the recited features being present in Yokogawa et al or Mizuno et al while dismissing many of the features as being routine or taking Official Notice. Again, applicants challenge the taking of Official Notice and request the Examiner to cite art regarding the features not shown in the cited art. Applicants submit that the dependent claims recite structural features not disclosed or taught in the cited art, such that the dependent claims should be considered allowable together with the parent claims.

With respect to claim 9 which depends from claim 1, and is rejected based upon the combination of Yokogawa et al and Gupta et al, applicants note that Gupta et al like Mizuno et al is directed to a CVD apparatus and not a plasma etching apparatus as disclosed and claimed. Applicants submit that it cannot be considered obvious to combine Yokogawa et al and Gupta et al and the resultant combination does not provide a ring-shaped member as recited in claim 1 and the dependent claims of this application. Thus, claim 9 also patentably distinguishes over the cited art in the sense of 35 U.S.C. §103, and should be considered allowable thereover.

In view of the above amendments and remarks, applicants submit that all claims present in this application should now be in condition for allowance and issuance of an action of a favorable nature is courteously solicited.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (500.37328X00) and please credit any excess fees to such deposit account.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Page 1, replace the paragraph beginning at line 6 and bridging pages 1 and 2 with the following new paragraph:

A plasma processing system conventionally employed to fabricate semiconductor devices, for example, a plasma etching system has been described in pages 55 to 58 of "Hitachi Hyouron", Vol. 76, No. 7 published in 1994. This is a magneto-[micro wave] microwave plasma etching system in which electromagnetic waves in a [micro-ware] microwave range are introduced via a magnetic field generated by a solenoid coil and a microwave circuit into a vacuum chamber filled with gas to produce plasma in the chamber. Since this system produces the plasma with a high plasma density at a low gas pressure, the machining of samples can be conducted at a high speed with high precision. Additionally, a magneto-[micro wave] microwave plasma etching system using local magnetic fields produced by permanent magnets has been described in pages 1469 to 1471 of "Appl. Phys. Lett.", Vol. 62, No. 13 published in 1993. Since the magnetic fields are generated by permanent magnets, the production cost and power consumption are considerably reduced in comparison with the conventional system. JP-A-3-122294 describes a technology in which plasma is generated by high-frequency waves in a range from 100 megahertz (MHz) to one gigahertz (GHz) to efficiently etch samples by use of a magnetic mirror (mirror magnetic field).

JP-A-6-224155 describes a technology in which high-frequency waves in a range from 100 MHz to 500 MHz are emitted from a comb-shaped antenna to produce uniform plasma in a chamber having a large diameter.

Page 2, replace the paragraph beginning t line 26 and bridging pages 2 and 3 with the following new paragraph:

It is therefore an object of the present invention to provide a plasma processing system and a plasma processing method to produce a uniform magneto-[micro wave] microwave plasma for a wide machining area with low power consumption.

Page 4, replace the paragraph beginning at line 3 with the following new paragraph:

Moreover, the systems of ECR type described in JP-A-3-122294 and JP-A-6-224155, however, electromagnetic waves are emitted from a position facing samples to be introduced to a plasma source of magneto-[micro wave] microwave plasma and hence only an insulating material can be placed at the position facing samples. In consequence, for example, when a high-frequency bias is to be applied to a sample, an earth electrode necessary for the bias cannot be placed at a desired or ideal position facing the sample. This leads to a problem of non-uniformity of the bias. Radicals in plasma exert essential influence on machining characteristics of samples. The radicals are under the influence of substances of walls of the vacuum chamber. Particularly, the substance of the wall at a position facing the sample and a

distance between the wall and the sample conspicuously influence machining characteristics of the sample. In other words, the radicals can be controlled by the substance of the wall and the distance. However, in the conventional systems of ECR type, only an insulating material, i.e., only quartz or aluminum oxide can be installed in practices at the position facing the sample, and hence the radicals cannot be controlled in a desired or ideal state.

Page 4, replace the paragraph beginning at line 26 and bridging pages 4 and 5 with the following new paragraph:

In the systems of narrow electrode type, the electrode exists at a position opposing to the sample as distinct from the systems of ECR type. This consequently solves the problem of the earth electrode to bias the sample and the problem that the radicals cannot be controlled by the material facing the sample. However, the gas pressure is relatively high in the narrow electrode type and [irons] ions incident to the sample are non-uniform in directivity, which leads to deterioration in the fine micro-machining. Furthermore, since the distance between the electrodes is at most about 30 millimeters (mm), there arises a problem of a large pressure difference between positions in a machining surface of sample when a gas is introduced at a high flow rate. The phenomenon becomes more apparent as the diameter of samples increases, namely, this is an essential problem to be solved for the machining of wafers of the coming generation having a diameter of 300 mm.

Page 5, replace the paragraph beginning at line 24 and bridging pages 5 and 6 with the following new paragraph:

In accordance with the present invention, there is provided a plasma processing system in which a highly uniform magneto-[micro wave] microwave plasma is produced with low power consumption even when the sample has a large machining area. The system can conduct finer machining with high selectivity and aspect ratio at a high speed. Particularly, radicals of the plasma are controlled with high precision independently of plasma generating conditions and hence the machining is achieved with high surface processing efficiency. Moreover, composition of radicals is kept unchanged in the plasma for a long period of time to continuously obtain stable machining characteristics.

Page 9, replace the paragraph beginning at line 9 and bridging pages 9 and 10 with the following new paragraph:

Fig. 1 shows an embodiment of the present invention. This is a basic configuration of a plasma processing system. The configuration includes a vacuum chamber 2 including a gas introducing unit 1. Disposed on chamber 2 is a magnet [3] 3A and 3B. Gas introduced into chamber 2 is transformed into plasma by interaction between electromagnetic magnetic waves introduced from a coaxial cable 4 onto a planar plate 5 and a magnetic field of magnet [3] 3A and 3B to thereby machine a sample 6. Plate 5 to emit electromagnetic waves is equivalent to that described in JP-A-9-321031. The planar plate 5 has a shape of a disk and has a central section thereof connected to

a conductor 34 having a shape of a circular cone of the coaxial cable 4. Applied to plate 5 are a frequency signal from a plasma generating power source of 450 MHz 7 and a power source of 13.56 MHz 9 via a filter 8. The magnetic field is required, in a plasma generation region between plate 5 and sample 6, to have intensity enough to cause electron cyclotron resonance. The magnetic field generated by the magnet 3A and 3B has magnetic lines of force with a direction vertical or substantially vertical to the planar plate 5 and the sample 6. Since a 450 MHz magnetic wave is employed in the embodiment of Fig, the intensity is in a range from 100 gauss to 200 gauss. Sample 6 has a diameter of eight inches and the distance between sample 6 and plate 5 is seven centimeters.

Page 17, replace the paragraph beginning at line 7 and bridging pages 17 and 18 with the following new paragraph:

By superposing power of 300 watt from 13.56 MHz power source 9 onto the 450 MHz wave, potential between film 10 on plate 5 and the plasma is adjusted. Sample 6 is a wafer with a diameter of 200 mm. The region of stand 11 which is brought into contact with sample 6 is kept at -20°C to regulate temperature of sample 6. Electromagnetic waves are fed from power source 18 onto sample 6 to control energy of ions fed from the plasma onto sample 6. Fig. 4 shows in a graph an etching speed of silicon oxide film and etching speed difference (selectivity) between silicon oxide film and silicon nitride film in the example above. The etching characteristic with respect to distance between silicon film

10 and sample 6 has been obtained by changing height of stand 11. To indicate the advantageous distance control of the present invention, the distance between silicon film 10 and sample 6 is set to a value larger than one half of the sample diameter, i.e., 140 mm. As can be seen from the graph of Fig. 4, although the etching [steed] speed is not greatly influenced by the distance, the etching selectivity remarkably varies depending on the distance. Particularly, the etching selectively is advantageously improved when compared with the etching selectivity in the distance below one half of the sample diameter, i.e., about 100 mm. This confirms usefulness of the present invention.

**IN THE CLAIMS:**

Please amend the claims as follows:

1. (amended) A plasma [processing] etching system for use with a surface [processing] etching apparatus in which in a vacuum chamber including vacuum generating means, source material gas supply means, sample setting means, and high-frequency power applying means, the source material gas is transformed into plasma to achieve surface [processing] etching of the sample, means for generating the plasma including electromagnetic wave supply means and magnetic field generating means, comprising:

control means for introducing the electromagnetic field from a planar plate disposed in parallel with the sample into the vacuum chamber, for setting distance between the plate and the sample to a value in a range from 30 mm to one half of the



smaller one of diameters respectively of the sample or the plate, and for controlling a quantity of reaction between a surface of the planar plate and radicals in the plasma;

means for making radicals incident to a surface of the sample uniform in quantity and type thereof including a ring-shaped member disposed in a periphery of the sample; and

means for reducing variation in time of radicals incident to the sample.

2. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the planar plate has a diameter ranging from 0.7 [time] times that of the sample to 1.2 times that of the sample.

3. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the electromagnetic wave to generate plasma has a frequency ranging from 300 MHz to 500 MHz.

4. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the electromagnetic field generated by the electromagnetic field generating means to generate plasma has intensity satisfying a condition for electron cyclotron resonance between the planar plate and the sample.

5. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the means for controlling

reaction between the surface of the planar plate and the plasma is means for superposing an electromagnetic wave of a second frequency onto the planar plate, the electromagnetic wave being different from the electromagnetic wave of a frequency ranging from 300 MHz 500 MHz.

6. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the means of controlling reaction between the surface of the planar plate and the plasma is means for controlling temperature of the planar plate.

7. (amended) A plasma [processing] etching system in accordance with Claim [1] 5, wherein the means for controlling reaction between the surface of the planar plate and the plasma is [the means of Claim 5 for superposing an electromagnetic wave of a second frequency onto the planar plate] means for superposing an electromagnetic wave of a second frequency onto the planar plate, the electromagnetic wave being different from the electromagnetic wave of a frequency ranging from 300 MHz 500 MHz and the means [of Claim 6 for controlling temperature of the planar plate] of controlling reaction between the surface of the planar plate and the plasma is means for controlling temperature of the planar plate.

8. (amended) A plasma [processing] etching system in accordance with Claim 5, wherein:

the second frequency of the electromagnetic wave superposed to the planar plate ranges from 50 kHz to 30 MHz; and

the frequency applied to the planar plate has power of 0.05 W/cm<sup>2</sup> to 5 W/cm<sup>2</sup>.

9. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein:

the planar plate includes a plurality of holes; and  
the source material gas is supplied through the holes.

10. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the planar plate includes a surface to be brought into contact with the plasma,

the surface being made of silicon, carbon, silicon carbide, quartz, aluminum oxide, or aluminum.

11. (amended) A plasma [processing] etching system in accordance with Claim 6, wherein the means for controlling temperature of the planar plate controls the temperature by circulating a liquid of which temperature is controlled in the planar plate.

12. (amended) A plasma [processing] etching system in accordance with Claim 10, wherein the gas supplying means is arranged at a position in the vacuum chamber,

the position is at an inner position of the vacuum chamber relative to the material surface arranged on the

surface of the planar plate to be brought into contact with the plasma.

Please cancel claim 13 without prejudice or disclaimer of the subject matter thereof.

14. (amended) A plasma [processing] etching system in accordance with Claim [13] 1, wherein the ring-shaped member includes a surface to be brought into the plasma, the surface being made of silicon, carbon, silicon carbide, quartz, aluminum oxide, or aluminum.

15. (amended) A plasma [processing] etching system in accordance with Claim [13] 1, wherein the ring-shaped member is applied with high-frequency power.

16. (amended) A plasma [processing] etching system in accordance with Claim 15, further including a wherein member to apply high-frequency power to the ring-shaped member, wherein

the power applying member is so configured to separate part of the high-frequency power applied to the sample to apply the part to the ring-shaped member.

17. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein means for reducing variation in time of radicals incident to the sample is a wall of the vacuum chamber and the planar plate [of Claim 1] and [the]

means for control of temperature of the ring-shaped member [of Claim 13].

18. (amended) A plasma [processing] etching system in accordance with Claim 14, wherein the ring-shaped member has a height ranging from 0 mm to 40 mm relative to the sample surface in a direction vertical to the sample surface.

19. (amended) A plasma [processing] etching system in accordance with Claim 14, wherein the ring-shaped member has a width ranging from 20 mm to the distance between the planar plate and the sample in a direction horizontal to the sample surface.

20. (amended) A plasma [processing] etching system in accordance with Claim 16, wherein the member to apply high-frequency power to the ring-shaped member and to separate part of the high-frequency power applied to the sample is a capacitor or has a function of a capacitor.

21. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the planar plate to supply an electromagnetic wave into the vacuum chamber is coupled via a dielectric substance to a plate at an earth potential[, the electromagnetic wave supplied resonate in transverse magnetic mode (TM) 01 in an dielectric substance enclosed between the planar plate and the earth-potential plate].

22. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein:

the planar plate has a shape of a disk;

the planar plate has a central section connected to a conductor in a shape of a circular cone; and

the planar plate supplies the electromagnetic wave via the conductor.

23. (amended) A plasma [processing] etching system in accordance with Claim 17, wherein:

the means for controlling temperature of the vacuum chamber, the planar plate, and the ring-shaped member controls the temperature by circulating a liquid of which temperature is controlled; and

the temperature controlled ranges from 20°C to 140°C.

24. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the magnetic field generated by the magnetic field generating means has magnetic lines of force, the lines having a direction vertical to the planar plate and the sample surface of Claim 1.

25. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the magnetic field generated by the magnetic field generating means has magnetic lines of force, the lines having a direction substantially vertical to the planar plate and the sample surface of Claim 1.

26. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein all or part of the surface of the planar plate to be brought into contact with the plasma is coated with dielectric.

27. (amended) A plasma [processing] etching system in accordance with Claim 26, wherein the dielectric covering all or part of the surface of the planar plate to be brought into contact with the plasma is quartz, aluminum oxide, silicon nitride, or polyimide resin.

28. (amended) A plasma [processing] etching system in accordance with Claim 26, wherein temperature of the dielectric is controlled to a fixed value in a range from 20°C to 250°C.

29. (amended) A plasma [processing] etching system in accordance with Claim 1, further including a filter in a power supply path to supply the electromagnetic wave with a frequency ranging from 300 MHz to 500 MHz to the planar plate, the filter allowing the high-frequency power applied to the sample to flow to the earth.

30. (amended) A plasma [processing] etching method for use with a plasma [processing] etching system in accordance with Claim 1, comprising the step of applying the high-frequency power with a frequency ranging from 200 kHz to 14 MHz to the sample with a density of 0.5 W/cm<sup>2</sup> to 8 W/cm<sup>2</sup> to

achieve surface processing of the sample.

31. (amended) A plasma [processing] etching system in accordance with Claim 15, wherein the high-frequency power is applied to the ring-shaped member with a density of 0 W/cm<sup>2</sup> to 8 W/cm<sup>2</sup> in the surface of the member to be brought into contact with the plasma.

32. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein:

a height relative to the sample surface and a width of the magnetic field region associated with the electron cyclotron resonance condition generated between the planar plate and the sample by the magnetic field generating means are controlled; and

radicals generated in the plasma is controlled.

33. (amended) A plasma [processing] etching system in accordance with Claim [1] 3, wherein:

the vacuum chamber includes an upper section made of an insulating material, i.e., quartz or aluminum oxide;

the system further including, on an atmosphere side of the insulating material, a planar plate arranged via dielectric [on the] at an earth-potential [conductor of Claim 20]; and

the electromagnetic wave [of Claim 3] is applied to the planar plate to generate plasma in the vacuum chamber through reaction between the electromagnetic wave and the magnetic



field.

34. (amended) A plasma [processing] etching system for [processing] etching a [planar] sample in a vacuum chamber including vacuum generating means, source material gas supply means, sample setting means, and high-frequency power applying means, the source material gas is transformed into plasma to achieve surface etching of the sample, means for generating the plasma including electromagnetic wave supply means and magnetic field generating means, wherein the sample is a planar sample, a ring-shaped member is disposed in a periphery of the sample so as to make radicals incident to a surface of the sample uniform in quantity and type thereof, and a distance between the sample and a member facing the sample ranges from 30 mm to one half of a diameter of the sample.

Please cancel claim 35 without prejudice or disclaimer of the subject matter thereof.

36. (amended) A plasma [processing] etching system in accordance with Claim 34, wherein the member placed at a position facing the sample is made of quartz, aluminum oxide, silicon, silicon nitride, silicon carbide, or polyimide resin.

37. (amended) A plasma [processing] etching method for use in a plasma [processing] etching system in accordance with Claim 1, comprising the steps of:  
using a mixture of argon and  $C_4F_8$  as the source material gas;

and

etching a silicon oxide film under conditions that argon has a flow rate ranging from 50 sccm to 2000 sccm,  $C_4F_8$  has a flow rate ranging from 0.5 sccm to 50 sccm, and the mixture has a pressure ranging from 0.01 Pa to 3 Pa.

38. (amended) A plasma [processing] etching method in accordance with Claim 37, further including the step of adding CO gas to the mixture to etch a silicon oxide film, the CO gas having a flow rate ranging 50 sccm to 300 sccm.

39. (amended) A plasma [processing] etching method in accordance with Claim 37, further including the step of adding oxygen gas to the mixture to etch a silicon oxide film, the oxygen gas having a flow rate ranging 0.5 sccm to 50 sccm.

40. (amended) A plasma [processing] etching method in accordance with Claim 37, further including the step of adding  $CHF_3$ ,  $CH_2F_2$ ,  $CH_4$ ,  $CH_3F$  hydrogen gas, or a mixture thereof is added to the mixture to etch a silicon oxide film, the gas added having a flow rate ranging 0.5 sccm to 50 sccm.

41. (amended) A plasma [processing] etching method for use with a plasma [processing] etching system in accordance with Claim 1, further including the step of using  $C_2F_6$ ,  $CHF_3$ ,  $C_3F_6O_5$ ,  $C_3F_8$ , or  $C_5H_8$ ,  $C_2F_4$ ,  $CF_3I$ ,  $C_2F_5I$ ,  $C_3F_6$  gas to etch a silicon oxide film.

42. (amended) A plasma [processing] etching system, wherein CO gas is added to the gas of Claim 41 to etch a silicon oxide film.

43. (amended) A plasma [processing] etching system, wherein oxygen gas is added to the gas of Claim 41 to etch a silicon oxide film.

44. (amended) A plasma etching method [for use with a plasma processing method] for use in the plasma [processing] etching system in accordance with Claim 1, comprising the step of:

using as the source material gas a mixture of argon and  $C_5F_8$ ; and

etching a silicon oxide film under conditions that argon has a flow rate ranging from 50 sccm to 2000 Sccm,  $C_5F_8$  has a flow rate ranging from 0.5 sccm to 50 sccm, and the mixture has a pressure ranging from 0.01 Pa to 3 Pa.

45. (amended) A plasma [processing] etching method for use in the plasma [processing] etching system in accordance with Claim 1, comprising the step of:

using chlorine as the source material gas; and

etching a material of silicon, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram under a condition that the gas has a pressure ranging from 0.1 Pa to 4 Pa.

46. (amended) A plasma [processing] etching method for use in the plasma [processing] etching system in accordance with Claim 1, comprising the step of:

using HBr as the source material gas; and

etching a material of silicon, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram under a condition that the gas has a pressure ranging from 0.1 Pa to 4 Pa.

47. (amended) A plasma [processing] etching method for use in the plasma [processing] etching system in accordance with Claim 1, comprising the step of:

using a mixture of chlorine and HBr as the source material gas; and

etching a material of silicon, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram under a condition that the mixture has a pressure ranging from 0.1 Pa to 4 Pa.

48. (amended) A plasma [processing] etching method in accordance with Claim 45, further including the step of:

adding oxygen gas to the source material gas to etch a material of silicon, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram.

49. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein methane gas, chlorine gas, nitrogen gas, hydrogen,  $CF_4$ ,  $C_2F_6$ ,  $CH_2F_2$ ,  $C_4F_8$ ,  $NH_3$ ,  $NF_3$ ,  $CH_3OH$ ,

C<sub>2</sub>H<sub>5</sub>OH or SF<sub>6</sub> is used as the source material gas to etch a material primarily including an organic substance.

50. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the magnetic field generated by the magnetic field generating means is intensity of 100 gauss or less between the planar plate and the sample.

51. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the plasma is generated without using the magnetic field generating means.

52. (amended) A plasma [processing] etching system in accordance with Claim [1] 5, wherein the second electromagnetic wave superpose to the planar plate in accordance with Claim 5 is divided to obtain part thereof to supply the part to the sample [in accordance with Claim 29].

53. (amended) A plasma [processing] etching system in accordance with Claim 1, wherein the electromagnetic wave to generate the plasma has a frequency ranging from 200 MHz to 950 MHz.

54. (amended) A plasma [processing] etching method for use in the plasma [processing] etching system in accordance with Claim 1, comprising the steps of:

using a mixture of Cl<sub>2</sub>+BCl<sub>3</sub>, Cl<sub>2</sub>+BCl<sub>3</sub>+CH<sub>4</sub>, Cl<sub>2</sub>+BCl<sub>3</sub>+CH<sub>4</sub>+Ar, Cl<sub>2</sub>+BCl<sub>3</sub>+CHF<sub>3</sub>, Cl<sub>2</sub>+BCl<sub>3</sub>+CH<sub>2</sub>F<sub>2</sub>, Cl<sub>2</sub>+BCl<sub>3</sub>+HCl, Cl<sub>2</sub>+BCl<sub>3</sub>+HCl+CH<sub>4</sub>+Ar,

$\text{Cl}_2 + \text{BCl}_3 + \text{N}_2$ ,  $\text{Cl}_2[, ] + \text{BCl}_3 + \text{N}_2 + \text{HCl}$ ,  $\text{Cl}_2 + \text{BCl}_3 + \text{CHCl}_3$ ; and

etching material of silica, aluminum, wolfram, or a material primarily including silicon, aluminum, or wolfram under a condition that the mixture has a pressure ranging from 0.1 Pa to 4 Pa.